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RATIONALE FOR THE 2008 REVISION TO HAWAIIAN STOCK BOUNDARIES FOR FALSE KILLER WHALES, *Pseudorca crassidens*

by

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Rationale for the 2008 revision to Hawaiian Stock boundaries for false killer whales, *Pseudorca crassidens*

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This document presents the rationale for stock boundary revisions incorporated in the 2008 Pacific Stock Assessment Reports for false killer whales (FKWs) around Hawai'i. One stock of FKWs has been recognized around the Hawaiian Islands: the Hawaiian Stock, with stock boundaries corresponding to the U. S. Exclusive Economic Zone (EEZ) around the islands. However, Chivers et al. (2007) provided genetic evidence for a demographically isolated population of FKWs around the main Hawaiian Islands. Here, we summarize available research on FKWs and explain the rationale behind changing the current Hawaiian Stock boundaries to recognize FKWs around the main Hawaiian Islands as a separate stock for management. Thus, the revised stock structure for the FKW Pacific Islands Stock Complex in the 2008 Pacific Stock Assessment Reports (Carretta et al., 2008) recognizes 1) a Hawaiian Insular Stock, 2) a Hawaiian Pelagic Stock, and 3) a Palmyra Atoll Stock.

Photo-identification Study

A photographic identification catalog of individual FKWs created by Baird et al. (2005) provides evidence that FKWs move among the main Hawaiian Islands, particularly between O'ahu and Hawai'i, and the 4-island area and Hawai'i. The catalog includes FKWs sampled within approximately 50 nmi of the main Hawaiian Islands and therefore does not provide information about more distant animal movements within the Hawaiian EEZ. However, there was one group of FKWs sampled farthest from shore (*i.e.*, 25-45 nmi) that did not include any individuals identified from FKW groups sampled nearer to shore (i.e., < 25 nmi; Baird et al., 2007).

The photographic catalog also documents FKWs with scars consistent with injuries caused by fishing lines, including longline gear and/or recreational gear that is used within the nearshore area of the main Hawaiian Islands (Baird and Gorgone, 2005).

Genetic Study

Chivers et al. (2007) provide the principal source of information supporting recognition of a FKW stock around the main Hawaiian Islands. Specifically, the phylogeographic concordance observed in the distribution of haplotypes was marked and revealed a set of

haplotypes for FKWs sampled around the main Hawaiian Islands that were not found elsewhere. This result was supported using standard statistical analyses: $\Phi_{ST} = 0.47$, $p < 0.0001$ for comparison of genetic diversity among the main Hawaiian Islands and several other regions within the eastern North Pacific Ocean (ENP). Thus, the genetic data indicate there is a demographically isolated population of FKWs associated with the main Hawaiian Islands. Furthermore, a small number of animals (n=5) sampled by observers aboard longline fishing vessels operating out of Hawai‘i > 75 nmi from the Main Hawaiian Islands had haplotypes that were the same or closely related to those found elsewhere in the ENP. Thus, there are at least two stocks of FKWs within the Hawaiian Islands EEZ.

The Chivers et al. (2007) genetic study can only be used to support recognition of a demographically isolated population around the main Hawaiian Islands, because there are too few samples available from other parts of the ENP to draw conclusions about stock structure throughout the region. Specifically, the data for the 5 samples mentioned above that were collected by observers on longline boats operating out of Hawai‘i only provides information that these animals are not part of the population of FKWs around the main Hawaiian Islands but is insufficient to conclude whether the animals belong to one or more stocks inhabiting the pelagic waters. At this time, there are too few data available for analyses of animal distribution, densities or genetics to make an inference about population structure in the pelagic waters surrounding Hawai‘i.

Because knowledge about FKW population structure is unlikely to increase significantly in the near future, a change in the Hawaiian Stock boundaries was implemented in the 2008 Stock Assessment Reports to recognize FKWs around the main Hawaiian Islands. This change makes the FKW stocks consistent with the best available data, especially the current genetic evidence and thereby improves the stock assessments made for this species in the Pacific Islands area.

Stock Boundary Revision

Based on this photographic and genetic data, we recommended a stock boundary be placed approximately 75 nmi from the main Hawaiian Islands to recognize the main Hawaiian Island FKW population as a separate stock for management. Placement of this boundary results in two stocks recognized within the currently recognized Hawaiian Stock: (1) a Hawaiian Insular Stock and (2) a Hawaiian Pelagic Stock. The location of this boundary should be re-evaluated as additional information becomes available.

Although the photographic data suggest some pelagic FKWs may be moving across this boundary (Baird and Gorgone, 2005; Baird et al., 2007), a 75 nmi distance has precedence as a fishery management boundary and our limited understanding of FKW ecology precludes defining and supporting an alternate boundary at this time. Specifically, the 75-nmi boundary corresponds roughly to the outer limit of the 25-75 nmi longline exclusion zone that was established to regulate longline fishing (Figure 1). This exclusion zone boundary varies with season in some areas, but the FKW stock boundary will be recognized year-round for management of the FKWs around the main Hawaiian Islands. Additionally, a 75 nmi zone around the main Hawaiian Islands has been used to

define strata for analyses of abundance estimates providing the necessary data to conduct a stock assessment (Barlow, 2006)

Abundance Estimates – Abundance estimates are available for both new stocks.

(1) Hawaiian Insular Stock. The photo-identification work by Baird et al. (2005) around the Main Hawaiian Islands provides a recent abundance estimate of 123 (CV=0.72) for the Hawaiian Insular Stock that updates the aerial survey estimate of 121 (CV=0.47) made by Mobley et al. (2000).

(2) Hawaiian Pelagic Stock. The SWFSC survey cruise called HICEAS was conducted within the Hawaiian EEZ in 2002. For analyses, two strata were defined: (1) a main Hawaiian Islands stratum, which extended from the islands out to approximately 75 nmi, and (2) an outer EEZ stratum, which extended from approximately 75 nmi from the islands out to the 200 nmi EEZ (Barlow, 2006). False killer whales sightings were only made in the outer EEZ stratum, and, therefore, the existing abundance estimate: 484 (CV=0.93) presented by Barlow and Rankin (2007) represents the Pelagic Hawai‘i Stock.

(3) Palmyra Atoll Stock. The data collected on the SWFSC survey cruise called PICEAS in 2005 provide additional data on false killer whale abundance outside the Hawaiian Islands EEZ (Barlow and Rankin 2007). The abundance of the Palmyra Stock of false killer whales is estimated to be 1,329 (CV=0.65) individuals. An additional 906 (CV=0.68) false killer whales are estimated to inhabit international waters between the Hawaiian Islands, Palmyra Atoll and Johnston Atoll EEZs.

FKWs in international waters and around the Palmyra Atoll -- We continue to recommend the Palmyra Atoll EEZ be recognized as a separate management unit, because there is a significant amount of fishing effort concentrated within the EEZ of Palmyra, and there is a possibility that a local FKW population inhabits waters surrounding the Atoll. Evidence for island-associated FKWs has been found for animals around the main Hawaiian Islands as detailed above, and a photographic study off Costa Rica concluded there was likely an island-associated population at Cocos Island (Acevedo-Guitiérrez et al., 1997). Thus, the precautionary approach to management for this species would be to recognize separate island stocks. Similarly, if FKWs are observed taken within the EEZs of the other atolls and islands of the U.S. Pacific Islands Region (*e.g.*, Johnston Atoll, Howland and Baker Islands, Jarvis Island, and American Samoa), we recommend recognition of separate management stocks.

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Figure 1. Proposed new stock areas for the Hawaiian Insular Stock and Hawaiian Pelagic Stock of false killer whales within the Hawaiian Islands EEZ.